

IN VITRO EVALUATION OF FUNGICIDES AND BIO-CONTROL AGENTS AGAINST *COLLETOTRICHUM CAPSICI*, INCITANT OF BLIGHT OF CHICKPEA

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ABSTRACT

A total of seven isolates were collected from major chickpea growing areas of Kurnool, Anantapur, Prakasam and Kadapa districts of Andhra Pradesh. The pathogen was isolated from infected leaves and pods and pathogenicity was confirmed. Disease severity test was conducted in which the isolate collected from Kurnool i.e., Cb 2 showed maximum disease severity than other isolates. Further Cb 2 was used for in vitro evaluation of fungicides and bio-control agents. Fungicides and bio-control agents were evaluated by pot culture experiment against the pathogen on popularly cultivated variety, JG-11 by imposing 12 treatments. Management of pathogen by fungicides and bio-control agents in pot culture experiment revealed that fungicide tebuconazole (0.1%) is more effective against the pathogen with less Per cent Disease Index (PDI) of 17.33 and more disease reduction of 73.00 followed by difenconazole (0.1%), hexaconazole (0.2%), kresoxim methyl (0.1%). Mancozeb + cymoxanil (0.25%) recorded PDI of 48.33 and disease reduction of 42.00 which is least effective against pathogen. Among the bio-control agents tested *Trichoderma koningii*, (0.4%) with PDI and disease reduction of 25.33 and 65.00 respectively was more effective followed by *Trichoderma harzianum* (0.4%) with PDI and disease reduction of 28.67 and 61.67 respectively.

KEYWORDS: *Colletotrichum Capsici*, Blight, Chickpea, Management

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INTRODUCTION

Pulses play a predominant role in agriculture due to their inherent ability to fix atmospheric nitrogen through Biological Nitrogen Fixation (BNF), which is economically sound and environmentally acceptable. Among the pulses, chickpea (*Cicer arietinum* L.) is the third most important pulse crop of the World. It is cultivated mainly in semi-arid and warm temperate regions of the world especially in *Rabi* season. Major constraints for potential chickpea yield are diseases, insect pests and poor management practices. Dry root rot and *Fusarium* wilt are the major diseases of chickpea prevailing in Andhra Pradesh. In addition to these two diseases, incidence of *Colletotrichum* blight was observed in severe form in Kurnool, Anantapur and Prakasam districts of Andhra Pradesh in recent years.

MATERIALS AND METHODS

Isolates of *Colletotrichum* blight pathogen in chickpea were collected from five major chickpea growing districts of Andhra Pradesh during *Rabi* season 2012-2013. A total of seven isolates were collected from seven different locations in five districts of AP. These isolates were designated as Cb 1, Cb 2, Cb 3, Cb 4, Cb 5, Cb 6 and

Cb 7 (Cb = *Colletotrichum* blight). Pathogen isolates were isolated from the leaves and pods showing typical symptoms of *Colletotrichum* blight disease by tissue segmentation method (Rangaswami and Mahadevan, 1999) on PDA medium. All the isolates of the pathogen were purified by single spore isolation method (Rangaswami and Mahadevan, 1999). The isolates of the pathogen were identified based on colony characteristics and spore measurements with the help of relevant monograph, illustrated books and CMI descriptions.

In Vitro Evaluation of Fungicides and Bio-Control Agents against the Pathogen

In the disease management studies, fungicides and bio-control agents were evaluated by pot culture experiment against the pathogen on popularly cultivated variety, JG-11 by imposing 12 treatments as given in Table 1. The pathogen isolate Cb 2 which was found highly virulent was used for the studies. Artificial inoculation of the pathogen was done in pot culture by spraying pure culture of the pathogen in the evening hours on twenty one days old plants in glasshouse and after spraying the pathogen sufficient humidity conditions were maintained to develop the disease. After the appearance of disease on seedlings, fungicides were sprayed twice at seven day interval. Finally disease severity is recorded in the treatments. Seed treatment of chickpea seeds was done with bio-control agents, *Trichoderma viride* (0.4 per cent), *Trichoderma harzianum* (0.4 per cent) and *Trichoderma koningii* (0.4 per cent), finally evaluated their efficiency by inoculating the pathogen onto the seedlings and Per cent Disease Index (PDI) was recorded. Control/Check is maintained by spraying only the test pathogen on chickpea seedlings.

RESULTS

Collection of Colletotrichum Blight Isolates

Chickpea leaves and pods infected with *Colletotrichum* blight disease were collected from Prakasam (Cb 1), Kurnool (Cb 2), Ananthapur (Cb 3, Cb 4 and Cb 5) and Kadapa (Cb 6 and Cb 7) districts of Andhra Pradesh.

Pathogenicity Test

Pathogenicity of the test fungus was established by inoculation and re-isolation of the pathogen from artificially inoculated chickpea plants. In the present investigation, pathogenicity test was conducted by foliar spray of aqueous spore suspension (1×10^8 spores / ml) on twenty one days old chickpea seedlings. The inoculated plants were provided with humidity > 90 per cent and maintained in glasshouse at $27 \pm 2^\circ\text{C}$. The plants were observed for the appearance of symptoms. The symptoms on the inoculated seedlings appeared as brown discolouration on basal portion of the stem, yellowing of lower leaves, brown circular spots developed on lower leaves, brown to dark brown lesions extended to branches and resulted in death of plants. The pathogen was re-isolated from the lesion area of inoculated plants and was found to be the same as the original culture, thus confirming the pathogenicity.

In Vitro Evaluation of Fungicides and Bio-Control Agents against the Pathogen

The use of fungicides has become an inevitable method in the management of plant diseases particularly in the absence of resistant cultivars. In the present study, an attempt was made to know the efficacy of different fungicides and bio-control agents on *C. capsici*, Cb 2 isolate by pot culture experiment. The results of the efficacy of different fungicides and bio-control agents are presented in Table 2 and Figure 1. From the data it is evident that all the treatments were significantly superior over control in reducing the per cent disease index. Maximum reduction was observed in treatment T₁ (tebuconazole, 0.1%) in which PDI of 17.33 and per cent disease reduction of 73.00 was recorded when compared to Treatment T₁₂, inoculated control which showed per cent disease index of 90.33.

The treatment T₁ is on par with the treatments T₄ (difenconazole, 0.1%), T₂ (hexaconazole, 0.2%) and T₁₁ (kresoxim methyl, 0.1%) in which per cent disease reduction of 72.33, 71.00 and 71.00 respectively was recorded. The next best treatments are T₅ (flusilazole, 0.1%), T₆ (azoxystrobin, 0.1%), T₃ (propiconazole, 0.1%) and T₇ (mancozeb + cymoxanil, 0.25%) in which per cent disease reduction of 60.00, 52.00, 47.00 and 42.00 respectively were recorded.

Among the bio-control agents tested against the pathogen T₈ (*Trichoderma koningii*, 0.4 %) was more effective followed by T₁₀ (*Trichoderma harzianum*, 0.4 %) and T₉ (*Trichoderma viride*, 0.4 %) in which per cent disease reduction of 65.00, 61.67 and 57.00 respectively was observed.

DISCUSSIONS

Among the different fungicides and bio-control agents tested against the pathogen, the fungicide tebuconazole, 0.1 % and bio-control agent *Trichoderma koningii*, 0.4 per cent are more effective against the pathogen in controlling the disease. Varaprasad (2000) evaluated the efficacy of different fungicides on growth of *Colletotrichum dematium*, blight pathogen of chickpea and reported that carbendazim (0.1%) and mancozeb (0.2%) completely inhibited (100%) the growth of the pathogen followed by kitazin (81.48%), difenconazole (71.48%) and triademefon (69.2%). Uday Krishna (2012) reported that among different fungicides and bio-control agents tested against *Colletotrichum* blight of chickpea, mancozeb (0.25%), tebuconazole (0.15) and hexaconazole (0.2%) recorded 100% inhibition over control. *Trichoderma koningii* was found to be more effective compared to *T. viride* in inhibiting the growth of *C. capsici*.

CONCLUSIONS

Colletotrichum blight of chickpea caused severe losses during rabi 2009 and 2010 in some areas of Kurnool, Prakasam, Anantapur and Kadapa districts, which resulted in failure of crop in many chickpea growing areas of Andhra Pradesh and was reported to be caused by *Colletotrichum capsici*. A total of 5 isolates were collected from different districts, out of which Cb 2 (Kurnool), which was found highly virulent was used for management studies in pot culture experiment. A set of eight fungicides and three bio-control agents were tested for their efficacy against *colletotrichum capsici* of which tebuconazole (0.1%) is more effective against the pathogen with less Per cent Disease Index (PDI) of 17.33 and more disease reduction of 73.00 and among the bio-control agents tested *Trichoderma koningii*, (0.4%) with PDI and disease reduction of 25.33 and 65.00 respectively was more effective.

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APPENDICES

Table 1: Details of Fungicides and Bio-Control Agents, their Trade Names and Concentrations Tested Against *Colletotrichum* Blight of Chickpea

Treatment	Name of the Fungicide	Trade Name	Dosage (%)
1	Tebuconazole	Folicur 25.9 % EC	0.1
2	Hexaconazole	Contaf 5 % EC	0.2
3	Propiconazole	Tilt 25 % EC	0.1

Table 1 Contd.			
4	Difencconazole	Score 25% EC	0.1
5	Flusilazole	Nustar 40 % EC	0.1
6	Azoxystrobin	Amistar 23 % SC	0.1
7	Mancozeb + Cymoxanil	Curzate M8 (64 % + 8 % WP)	0.25
8	<i>Trichoderma koningi</i>	NBAIL, Bangalore isolate	0.4
9	<i>Trichoderma viride</i>	Biofit	0.4
10	<i>Trichoderma harzianum</i>	Binab – T	0.4
11	Kresoxim methyl	Ergon 44.3 SC	0.1
12	Control/Check	--	--

Table 2: In Vitro Evaluation of Fungicides and Bio-Control Agents against the Pathogen

S. No.	Treatment	Per Cent Disease Index	Per Cent Disease Reduction Over control*
T ₁	Tebuconazole, 0.1 %	17.33 (24.608) ^g	73.00 (64.066) ^a
T ₂	Hexaconazole, 0.2%	19.33 (26.096) ^g	71.00 (62.475) ^a
T ₃	Propiconazole, 0.1 %	43.33 (41.177) ^{bc}	47.00 (46.136) ^{ef}
T ₄	Difencconazole, 0.1 %	18.00 (25.111) ^g	72.33 (63.529) ^a
T ₅	Flusilazole, 0.1 %	30.33 (33.403) ^{ef}	60.00 (54.670) ^{bc}
T ₆	Azoxystrobin, 0.1 %	38.33 (38.263) ^{cd}	52.00 (49.359) ^{de}
T ₇	Mancozeb + Cymoxanil, 0.25%	48.33 (44.067) ^b	42.00 (43.008) ^f
T ₈	Trichodermakoningi, 0.4%	25.33 (30.187) ^f	65.00 (58.085) ^b
T ₉	Trichodermaviride, 0.4%	33.33 (35.259) ^{de}	57.00 (52.617) ^{cd}
T ₁₀	Trichodermaharzianum, 0.4%	28.67 (32.379) ^{ef}	61.67 (55.753) ^{bc}
T ₁₁	Kresoxim methyl	19.33 (26.087) ^g	71.00 (62.492) ^a
T ₁₂	Control/Check	90.33 (71.985) ^a	0.00 (0.00) ^g
	SEm±	1.074	1.157
	CD (5%)	3.154	3.396

* Mean of three replications

Figures in parenthesis are angular transformed values



Figure 1: In Vitro Evaluation of Fungicides and Bio-Control Agents against the Pathogen